

INSECT PESTS OF GUAYULE GROWN IN THE GREENHOUSE

By _____

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Insect problems relative to guayule (*Parthenium argentatum* Gray) grown in greenhouses are, as far as known, entirely new. Lloyd (1) refers to a few insects encountered in the growing and processing of rubber but does not mention any greenhouse pests. It is doubtful if enough guayule has been grown under glass to furnish a habitat for insects under these conditions prior to the organization of this project.

With the inception of the guayule program at Salinas, augmented by a research program for the development and promotion of all phases of the work, there has been a large amount of guayule grown under glass. This, of course, is justifiable from the standpoint of rapid progress. It is possible to crowd several seasons work into one when proper growing conditions can be maintained in a greenhouse. However, with the growing of relatively large amounts of guayule under favorable conditions there has also developed a problem of insect control. The pests thus far encountered are not confined to, or specific on, guayule but are common greenhouse pests that attack a wide range of plants. Various control measures have been used against these insects but which ones could be used on guayule was a matter to be determined. Furthermore, the different varieties and their response to insecticides was a point for consideration, as well as the fact that in one case an insecticide could not be used because of its chemical composition which would interfere with the original experiment. There was, and there still remains, a certain amount of work that must be done in conjunction with the application of insecticides to guayule.

Location and size of greenhouses

Greenhouses under consideration include three wings of the Salinas greenhouse, three greenhouses in the Watsonville area, and one large greenhouse at Capitola. These comprise approximately 30,000 square feet of floor space, or 330,000 cubic feet which is the figure to be considered for any fumigation work. The Salinas greenhouse has each wing subdivided into three units. These facilitate control work as each unit is independent of the others and can be treated accordingly. The greenhouses in the Watsonville area are relatively small and can be treated as units without undue concern. The Capitola greenhouse is fairly large and not subdivided. Infestations can spread readily throughout the entire area.

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Materials

A number of insecticides as sprays, dusts, or fumigants have been tried on guayule in the greenhouse. Sprays experimentally used thus far include tartar emetic with sugar, syrup, or glycerine; 1 percent white oil and kerosene emulsions with ground derris root, and nicotine sulfate with molasses or syrup. Dusts include sulfur, nicotine, calcium arsenate and cryolite. Only two fumigants, nicotine and hydrocyanic acid gas have been used to date. Some of these materials have caused injury and they will be discussed more in detail later.

Methods of application

Various methods have been used in applying the insecticides. In the early work small hand atomizing sprayers were used. These gave good coverage with economy of material but were slow and laborious. Two types of larger hand sprayers were used but were not too satisfactory for the work. More recently a paint gun has been used and is very satisfactory for some sprays. It is operated from a power compressor at about 40 pounds pressure. This can be used at any of the greenhouses as the compressor is mounted in the back of a pick-up truck. For some of the water sprays where thorough wetting is desired the atomizing paint gun is not satisfactory. To meet this need Mr. E. F. Smith had a heavy metal container constructed so that insecticides could be placed in it, sealed, then placed on an air line thus subjecting the liquid to continuous high pressure.

For insecticidal dusts both the small plunger type dusters and the larger rotary hand dusters have been used. Both have been satisfactory, the type depending largely on the size of plants and extent of infestation.

The only fumigation work carried on at the present time is with nicotine. For uniformity and simplicity a commercially prepared product, Nicofume, made specifically for fumigation work has been used.

One experimental fumigation with hydrocyanic acid gas using sodium cyanide and sulfuric acid at the rate of one ounce sodium cyanide per 1000 cu. ft. burned guayule without giving satisfactory control of aphids so the use of this material was abandoned temporarily. Further work with calcium cyanide will be discussed under white fly control.

Insects and Control

The three major pests thus far encountered are red mites, white flies, and thrips. Other pests include mealy bugs, aphids, cutworms, crickets, ants, snails and slugs.

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The red mites have been the most troublesome. These are not true insects but as their common name implies are mites belonging to the class Arachnida or spiders. They are very tiny, being only about one-fiftieth of an inch in length. The damage is so akin to that of insects that their control has generally been handled by entomologists. Although there are a number of species most of them spin webs, and these tiny webs afford some protection against various control practices. Most of the population is present on the under surfaces of the leaves. In some cases, and this seems to be true of guayule, there is a tendency for leaves to curl as infestations build up, thus further increasing the difficulty of control.

One of the commonest methods of control of red mites is the use of dusting sulfur. This was used on some of the first infestations of Tetranychus bimaculatus Harvey (Det. E. A. McGregor) in the Watsonville area with very good results. Only one very heavy application was made. An examination some ten days after treatment showed all mites dead.

Dusting sulfur was used at Salinas at a later date against another species (probably Tetranychus telarius Linn.). The plants that were infested included mariola (Parthenium incanum H.B.K.) guayule (P. argentatum), and crosses between the two species. These plants had been sprayed several times at an earlier date with a commercial pyrethrum-rotonone water spray, but a red mite infestation developed in spite of it. The sulfur caused considerable burning to the older leaves of mariola but fortunately no serious injury to the plants. Some of the crosses between mariola and guayule were also burned in varying degrees but the guayule was uninjured. It was thus apparent that there was a big variation in tolerance to sulfur between the two species. This experience further emphasized the importance of taking all possible precautions in testing insecticides before applying them to experimental plants.

The present method of control for red mites is a tartar emetic-glycerine spray. This is prepared with 20 grams tartar emetic and 90 cubic centimeters glycerine per gallon of water, or at the rate of about four and one-half pounds tartar emetic and two and one-third gallons of glycerine per 100 gallons of water. Sugar or syrup is used in place of the glycerine under field conditions, but in greenhouses the sweet materials serve as media for fungi.

White flies are tiny white insects closely related to the scale insects. They are well named and once seen are not likely to be confused with other insects. The immature forms cause damage to the plants by attaching themselves, sometimes in great numbers to the undersurfaces of the leaves and sucking the plant juices. Control of these insects can be obtained with an oil emulsion spray or hydrocyanic acid gas fumigation. The addition of rotonone, either as the ground root or an extract,

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increases the efficiency of the spray. For spraying guayule a one percent oil emulsion with rotonone was used. In one greenhouse at Watsonville sprayed November 12, the kill of larvae after 11 days was 90 percent. An important consideration with this spray, as well as most sprays, is thorough coverage. In some instances, especially with small plants in pots, it is necessary to pull the leaves up to get the spray on the under side of the leaves. When adults were numerous a nico-fume fumigation the night before spraying served to kill many adults and reduce activity of the others so that the spray efficiency against adults was increased.

Although cyanide fumigation is the usual method of control for white flies in greenhouses, it has not been used on guayule due to the preliminary work which showed plant injury from this material. Recently the Washington office suggested the use of calcium cyanide at a much lower rate than the sodium cyanide had been used. This was tried on a unit of the Salinas greenhouse December 21-22 using one ounce calcium cyanide for 7,500 cubic feet of space, or very slightly over 1/8-ounce per 1,000 cubic feet. All adult white flies were killed but there was injury to the tender growing plants. Another unit was fumigated the following night with dosage reduced to 1/8 ounce per 1,000 cubic feet. There was still injury to the tender leaves near the growing tip. The terminal buds, however, were not affected. Furthermore, plants in the cotyledon stage, presumably the tenderest plants, were not injured. Control of flies was about 95%, recorded the following morning. Future tests with lower dosages of this material might prove satisfactory for the control of this insect.

Thrips have caused considerable concern by their distorting of leaves and stunting of plants. It is doubtful if they would kill plants, but by feeding on some and stunting them they can completely upset the results of an experiment. The tartar emetic-sugar spray as mentioned under red mites is very effective against these insects. In fact, the tartar emetic spray was originally developed for citrus thrips and was found by other workers to be effective against red mites. In some of the experiments on soil nutrients, however, it has been impossible to use tartar emetic due to its chemical composition. In place of the tartar emetic, a spray of nicotine sulfate with molasses or syrup has been used. The glycerine has not been tried with nicotine sulfate as this work was done prior to the substitution of glycerine for the sweetening materials.

With regard to aphids the nico-fume fumigation was found to be the easiest, most effective, and probably the cheapest method. In cases where the nicotine fumigation is not feasible the nicotine dusts or sprays should be satisfactory. The nicotine "10" dust, that is 10 lbs. of 40 percent nicotine sulfate to 100 lbs. of prepared dust, was used experimentally and found very effective.

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Due to war conditions such materials as pyrethrum, rotonone, and tartar emetic are scarce and rather difficult to obtain. It may be necessary to substitute other materials for these, in which case, additional testing and checking will be necessary. Several such materials are on order, or have recently been received, and will be tried as time and conditions permit.

To sum up the problem of pest control in greenhouses: the work is an aid to the general research program; greenhouses located at Salinas, Watsonville, and Capitola have a floor space of approximately 30,000 square feet; various types of spraying and dusting equipment have been used; principal insect pests are red mites, white flies and thrips, controlled by tartar emetic, oil emulsions, and nicotine sulfate. Control methods are sometimes complicated by varieties involved, or by the nature of the original experiments. War conditions may necessitate further changes in control practices due to scarcity of several materials.

Literature cited.

- (1) Lloyd, Francis Ernest. 1911

Guayule A Rubber-plant of the Chihuahuan Desert. Published by the Carnegie Institute of Washington. 213 pp. Illustrated